Portable Digital Leakage Detector Operation Manual (DRV3)





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1. General Information

1.1 About this Manual

This manual describes the features, operation and setup of the DRV3 digital portable leakage detection meter.

You will find important safety information in this manual. We strongly recommend that all users read this manual. Use of this product other than for its intended application may compromise the unit's safety features

1.2 Explanation of Symbols Used

The following symbols are used in this Manual:

Symbol

Explanation



Direct current.



Caution. Indicates that operations or procedures, if carried out without caution, may cause personal injury or damage to the unit.



Note. Indicates additional information about the product.

1.3 Certifications

This section describes the certifications the DRV3 complies with.

1.3.1 Tests Specifications

FCC 47 CFR Part 15, Subpart B – Verification

ICES-003/NMB-003 Issue 4 February 2004

Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: Generic requirements.

1.3.2 FCC Part 15 Class A

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.





NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Modifications: Any modifications made to this device that are not approved by Effigis may void the authority granted to the user by the FCC to operate this equipment.

IC ICES-003 Class A Notice - Avis NMB-003 Classe A

This Class A digital apparatus complies with Canadian ICES-003.

1.4 Technical Support

Effigis Technical Support Service is available from Monday through Friday from 9:00 AM to 5:00 PM Eastern Time.

Toll free from U.S. and Canada: + 1 888 495-6577

International: + 1 514 495-0018

Fax questions anytime to: + 1 514 495-4191

cpat@effigis.com

1.5 Calibration

Your DRV3 unit has been calibrated and tested in the factory, and does not need further calibration before use.

However, if the unit suffers damage or is repaired, it is recommended that the unit be calibrated by an authorized Efficis service center.

As well, if your company requires regular calibration of all equipment, or requires a calibration certificate for the DRV3, a calibration service is available through Effigis.

For more information on calibration services, please contact your Effigis representative.

1.6 Effigis Website

Effigis' website contains product specifications, information, press releases, brochure download and Frequently Asked Questions (FAQs). Please visit our website at: http://effigis.com

2. System Components

The DRV3 is a portable signal leakage detection meter designed to operate in all-digital cable networks. It functions as a portable dual-band find-and-fix meter and as a monitoring probe when part of the CPAT FLEX system. It is frequency agile from 118 to 140 MHz (Mid band tuner) and from 572 to 960 MHz (LTE band tuner). The DRV3 can easily be set up via its intuitive user interface.

This section describes the DRV3 unit in detail including its accessories, and helps you get started by explaining the features, the use of the buttons, and the powering and data interfaces on the unit.

2.1 Initial Verification

Your DRV3 unit is charged, calibrated, and ready to use right out of the box. Upon reception, visually inspect each item for any damage that may have occurred during shipping. If you see any signs of physical damage, please contact Effigis:

- Callers from the U.S. and Canada can dial +1 888-495-6577 (toll-free number)
- International callers can dial +1 514 495-0018.

If there are no apparent signs of physical damage, turn on the unit by pressing the button, approximately 3 seconds, and make sure the unit boots up properly.

Make sure no items are missing. Your package should contain all the standard items as well as any accessories you may have ordered. If you ordered the DRV3 portable leakage detection meter kit, the following items are included:

- DRV3 meter, including its rechargeable battery pack
- Rubber duck antenna, for Mid band measurements, with BNC connector
- Rubber duck antenna, for LTE band measurements, with SMA connector
- Vehicle docking station
- Docking station's flex post
- AC adapter
- User manual





Figure 1: DRV3 portable leakage detection meter kit

If any of the standard accessories are lost or damaged, you can order a replacement for the DRV3. Please quote the following part numbers when placing an order:

	Part No.	Accessory Description
1	110-00005-001	AC adapter
2	110-00010-001	+12 VDC power supply
3	008-00002-001	Battery pack
4	111-00022-001	Mid band rubber duck antenna (BNC connector)
5	111-00031-001	LTE band (572-698 MHz) rubber duck antenna (SMA connector)*
	111-00007-001	LTE band (698-806 MHz) rubber duck antenna (SMA connector)*
	111-00008-001	LTE band (806-866 MHz) rubber duck antenna (SMA connector)*
	111-00020-001	LTE band (821-902 MHz) rubber duck antenna (SMA connector)*
	111-00025-001	LTE band (902-960 MHz) rubber duck antenna (SMA connector)*
6	150-00032-001	Vehicle docking station
7	150-00031-001	DRV3
8	012-00020-011	Docking station's Flex post
9	100-00001-001	DRV3 user manual

^{*} One of these antennas / Part number changes according to frequency ordered by customer.

To place an order, please call Effigis at + 1 888 495-6577 or + 1 514 495-0018

2.2 DRV3 Optional Accessories

2.2.1 Antennas

The DRV3 comes with two rubber duck antennas for leakage detection. The one with the BNC connector is for the Mid band. The one with the SMA connector is for the LTE band. However, other antennas available from Effigis can also be used.



NOTE

Only antennas obtained from Effigis can be used effectively with the DRV3. Each Effigis antenna has been analyzed and the appropriate compensation has been designed into the DRV3 for optimal results. Effigis cannot guarantee proper results with an antenna from any other source.

Part No.	Antenna Accessories Description
112-00004-100	Mid Band Monopole Quarter-wave VHF Antenna Kit (includes magnetic base + whip antenna + BNC terminated cable)
112-00009-100	LTE Monopole Quarter-wave Antenna Kit (includes magnetic base + whip antenna + SMA terminated cable)

2.3 Features

The DRV3 is a high performance dual band find-and-fix leakage detection meter that offers many features including:

- Fully agile in both bands, from 118-140 MHz (Mid-band tuner) and 572-960 MHz (LTE-band tuner)
- User-adjustable frequency displayed in 100 Hz steps
- 3 favorite frequency presets
- Based on Effigis's CPAT leakage monitoring system technology



NOTE

In both bands, leakage detection is based on signal tag recognition to filter noise from real leakage points. This means that monitored frequencies must be tagged in order to detected leakage. See your documentation on the DSG1 module for more details on tagging channels.



2.4 Physical Overview

Orange

2.4.1 Startup

When you press the on/off button (hold ~ 3 sec.), the DRV3 begins to load its operating software and parameters. During this process, the power light on the top right of the DRV3 flashes green and red briefly, then remains lit green. The battery indicator light turns green briefly as the unit checks the battery, then changes to indicate powering as follows:

Plugged in and charging, and operating on external power

Green Plugged in and fully charged, operating on external power

Off or Backlit Operating on battery power; lighting depends on backlight settings

2.4.2 Front View Buttons and Display

The seven front panel buttons on the DRV3 allow you to turn on and off the unit, navigate menus, take snapshots and toggle the unit's volume between mute and its preset reference level.



Figure 2: Front view of DRV3

2.4.3 Power and Data Interface

The DRV3 has one round pin interface on the bottom of the unit, used only to connect the AC adapter (supplied by Effigis) when the docking station is not used. This connection allows you to recharge the battery and power the DRV3.

When the DRV3 is connected to the docking station, power and data connections with the unit are made through the 9 pads located on the back of the unit, which line up with the docking station's mating connectors.



Figure 3: Bottom view of DRV3 unit

2.4.4 Docking Station (optional)

The docking station provides a quick means of connecting and disconnecting the DRV3, without having to unplug any cables. The 9 mating connectors align with the pads on the rear of DRV3 to link power and data to the DRV3. In addition to this basic connection, there are two connections for the leakage detection antennas. See section 2.4.5 Antenna Connectors on page 13 for further details.

The docking station is equipped with a round connector at the rear, used to power the unit



and charge the battery while the DRV3 is docked. It also has a USB type A receptacle used as a data interface with the ARD4 autonomous monitoring module, allowing it to take control of the unit. This USB connection is also used for firmware upgrades.



Figure 4: Docking station and rear view of DRV3



WARNING:

Do not plug 2 adapters simultaneously to power the DRV3. The docking station is designed to prevent connecting a power adapter to the bottom of the DRV3 when docked.

The docking station is available with a flexible mounting post that is designed to be installed in a service vehicle. For further details and installation procedures, see section 3.1 Docking Station Installation starting on page 16.

2.4.5 Antenna Connectors

The 2 connectors at the top of the unit are designed for the rubber duck antennas. These antennas are used only when the unit is not docked.



Figure 5: Top view of DRV3

As soon as the DRV3 is docked, there is an internal mechanical switch that transfers the RF input readings to the docking station.

The docking station relays the RF signal from the antennas installed on the vehicle's rooftop. The Mid-band and the LTE-band antennas must be connected to the BNC connector and the SMA connector respectively, both located at the back of the docking station.





Figure 6: Rear view of docking station



Figure 7: Rooftop antenna connexions



NOTE

The link with the DRV3's tuners is made through the two small round connectors on the front of docking station which align with the 2 holes protected by the slider located at the back of the DRV3. The slider automatically opens when docked. Do not insert any foreign objects into the sliders.

2.4.6 Speaker

The DRV3 is equipped with a speaker that emits an audio tone through the openings at the rear of the unit to provide audio feedback of RF measurements. Most of the time, the readings from both bands will be different. The audio tone will always reflect the highest leakage measurement.

2.4.7 Battery

The DRV3 is powered by a Li-lon 7.2 V 3.1Ah battery pack that has a 5-pin connector to interface with the unit. Even though the battery pack may not be fully charged when the DRV3 is shipped, your unit is ready to use out of the box. For information on charging the battery, see section 4.4 Charging the Battery on page 31.



3. Setup

3.1 Docking Station Installation

3.1.1 Safety Precautions for Installation

Never install this product in places where, or in a manner that it could injure the driver or passengers if the vehicle stops suddenly.

Never install this product in places where, or in a manner that it may interfere with the driver's operation of the vehicle, such as on the floor in front of the driver's seat, or close to the steering wheel or shift lever.

Make sure there is nothing behind the dashboard, the floor or the paneling when drilling holes in them. Be careful not to damage fuel lines, brake lines, electronic components, communication wires or power cables. When using screws, do not allow them to come into contact with any electrical leads.

To ensure proper installation, use the supplied parts in the manner specified. If any parts other than the supplied ones are used, they may damage internal parts of this product or they may work loose and the product may become detached.

It is extremely dangerous to allow the cables to become wound around the steering column or shift lever. Be sure to install this product, its cables, and wiring away in such a way that they will not obstruct or hinder driving.

Make sure that leads cannot get caught in a door or the sliding mechanism of a seat, resulting in a short circuit.

Do not install this system where it may (i) obstruct the driver's vision, (ii) impair the performance of any of the vehicle's operating systems or safety features, including airbags, hazard lamp buttons or (iii) impair the driver's ability to safely operate the vehicle.

Never install the system in front of or next to the place in the dash, door, or pillar from which one of your vehicle's airbags would deploy. Please refer to your vehicle's owner's manual for reference to the deployment area of the frontal airbags.

Do not install the system in a place where it will impair the performance of any of the vehicle's operating systems, including airbags and headrests.

3.1.2 Installing the Docking Station

The docking station is designed to allow simple connection/disconnection of the DRV3 from power, data and external RF antennas. It typically mounts on a flex post secured to the vehicle's passenger floor near the 12V power source so the DRV3 can remain in the support bracket while charging. You will require 3 screws (not included) to secure the flex post to the floor.

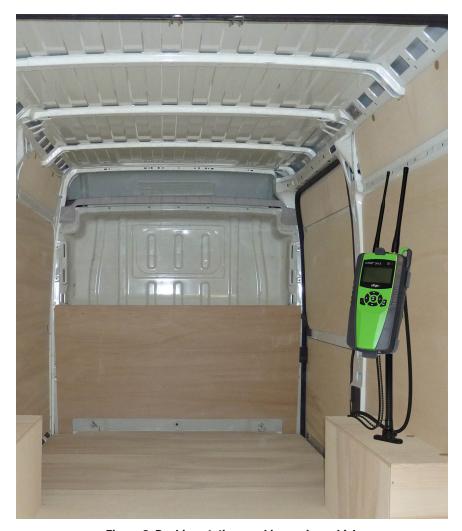


Figure 8: Docking station used in service vehicle



CAUTION!

Do not disconnect or modify any vehicle security systems such as airbags or seatbelts. Security systems wires use yellow sleeves and yellow connectors. Accidental triggering of these systems may cause severe injuries.



To install the support bracket:

- 1. Install the Flex post.
 - Firmly attach the Flex mount bracket to the vehicle floor using 3 metal screws (not included)
 - Screw the post into the bracket.
 - Affix the flex post to the bracket with the hexagonal screw.
- 2. Attach the docking station.
 - Attach the DRV3 docking station to the Flex post assembly using the 4 pan head Phillips screws (included with the docking station).
 - Adjust docking station's angle and orientation, and tighten the thumbscrew to secure it in this position.
- 3. Connect the docking station cables.
 - Connect the SMA cable from the vehicle roof antenna (LTE band) to the top right RF interface.
 - Connect the BNC cable from the vehicle roof antenna (Mid band) to the top left RF interface.
 - Plug in the DC cable to power vehicle accessories.
 - Plug in the USB cable (required only if the DRV3 is used with an ARD4).
 - Secure cables with a cable tie.
- 4. Connect the DRV3 to ARD4 (optional).
 - If you are using the ARD4 module, connect the other end of the USB cable from the docking station to the ARD4.
- 5. Insert the DRV3 into the docking station.
 - Start by first sliding the bottom of the unit into the station.
 - Then, gently press the top of the unit until the DRV3 slides under the top clip. You will hear a click when the clip engages.

For further details, see the installation diagram on page 38.

3.2 DRV3 Parameters

When used in autonomous measurement mode (with the optional ARD4 module), all operating parameters are set automatically by the ARD4.



NOTE

In autonomous measurement mode, access to menus is blocked to prevent any changes to operating parameters. The menus are available as soon as you exit this mode.



NOTE

After being set up in autonomous mode, the autonomous mode parameters will stay active until the user provides new settings.

When used as find-and-fix tool, the parameters are set using the DRV3 menus. The following sections describe how to set up the DRV3 using the unit's own menus.

3.2.1 Accessing and Navigating the Setup Menus

Upon startup, the DRV3 defaults to measurement mode. In order to change the frequency, enable or disable tagging, adjust the volume, change the units of measure or change any other display setting, you must switch to setup mode.

To go to setup mode, press any of the four arrow buttons. Once you are in the settings menu, you can move through the list of configurable elements by scrolling up and down with the arrows.

To change the settings of an element, press the right arrow (\blacktriangleright) or the **Enter** button (\hookleftarrow) when the cursor is over the desired element of the menu in the left column. This moves the cursor to the right column, where you can then select a new value among the presets, or edit a numerical value by highlighting the digit and then pressing the up or down arrow to obtain the desired number. To save a new setting and return to the left column, press the left arrow (\blacktriangleleft) or the **Enter** button (\hookleftarrow). When editing numerical values, press **Enter** button (\hookleftarrow) or **Esc** to return to the left column.

In order to **save** values and exit the settings menu, press the left arrow (\triangleleft) or the **Enter** button (\triangleleft); to exit the menu **without** saving, press **Esc**.

Please refer to the following sections for details on configuring each element in the five separate pages that constitute the settings menu.



3.2.2 Setting up Antennas

The DRV3 uses 2 sets of antennas for each band (Mid/Aero and LTE bands). The 'DRV' set allows you to specify parameters for the antennas connected directly to the connectors on top of the DRV3. The 'roof' set is for the antennas connected to the docking station, linked via cables to antennas on the vehicle's roof or other external antennas.



NOTE

Do not change the antenna type in the DRV3 unless you are physically connecting a different antenna.

The DRV3 comes with rubber duck antennas and this is the default antenna type for leakage detection in portable mode. Effigis offers other types of antennas that can be used with the DRV3. Regardless of the antenna you are using, it is very important to make sure the DRV3's settings match the actual antenna type connected to the unit in order to accurately measure signal strength. Using an antenna that is not authorized by Effigis, or setting up the DRV3 with the wrong antenna type will result in erroneous readings.

To change the antenna type:

- 1. In the settings menu (page 1), select Antennas.
- 2. Press the right arrow (▶) or the **Enter** button (←), then scroll through the antenna types using the up and down arrows until you have highlighted the antenna connection you want to edit.

The possible values are:

- AFRO ROOF
- AFRO DRV
- LTE ROOF
- LTE DRV
- 3. Select the type of antenna that is physically connected to the selected antenna interface.

The possible values are:

- Rubber* Default value
- Dipole
- Monopole
- None** Used by Effigis service personnel for maintenance/calibration purposes

- 4. Press **Enter** (←) or Left Key to save your choice.
- 5. Press **Esc** to return to the settings menu and continue configuring other parameters. Press **Esc** again to return to measurement mode.



NOTE

In autonomous mode, the DRV3 always uses the 'roof' antennas since it requires the DRV3 to be docked in order to operate in this mode.

3.2.3 Setting up Proximity

The proximity setting is used to apply a correction factor to the distance between the DRV3 and the probable leakage source in order to give a reading equivalent to a 10ft/3m measurement. By selecting the distance, the DRV3 calculates the appropriate gain to apply to the reading and then provides a normalized reading.

To change the Proximity:

- 1. In the settings menu (page 1), select Proximity.
- 2. Press the right arrow (▶) to choose the estimated distance to the leakage point.

The possible values are:

- 3 meters (approx. 10 ft)* Default value
- 10 meters (approx. 30 ft)
- 25 meters (approx. 80 ft)
- 3. Depending on your selection, the DRV3 will then apply the appropriate gain to the reading to help you discriminate the noise source. Use the arrows to make your selection.
- 4. Press **Enter** (←) to save the value.
- 5. Press **Esc** to return to measurement mode, or select another item in the settings menu and continue configuring other parameters.

3.2.4 Setting up Bands

The band setting is used to select the frequency ranges over which you are looking for leakage. The DRV3 is fully agile over two bands: a mid-range band from 118-140 MHz, and an LTE band from 572-960 MHz. By default, the DRV3 is set up for both bands, and your DRV3 screen is split in two when in measurement mode, in order to display values for both bands. If you enable only one of the bands, the screen is not split and only one leakage signal level is displayed.





NOTE

Using only one band will reduce power consumption by 30% to 40%, allowing longer battery autonomy.

To select the detection band:

- 1. In the settings menu (page 1), select Bands.
- 2. Press the right arrow (▶) to toggle between Aero/LTE (default), Aero (mid-range) or LTE.
- 3. Press **Enter** (←) to save the value. The cursor automatically returns to the left column. Continue configuring other parameters if desired.
- 4. Press **Esc** to return to measurement mode.
 - 3.2.5 Setting up Sound

Reference Volume

The DRV3 can emit an audible tone to provide an audio feedback of measurements. The volume setting affects the basic reference level for the tone. During normal use, unless the 'mute' option is used, the tone increases with the leak's signal strength. The reference volume of the tone can be set to LOW, MED or HIGH, or the sound can be turned off with the 'mute' option. In measurement mode, the DRV3's current volume setting is shown on screen with the following icons:

Low	Medium	High	Mute
→	=	4 0	\times



NOTE

You can use the **Esc** key to toggle between Mute and the reference volume (low, medium or high). However, to change the reference volume, you must use the setup menu.

Squelch

In order to prevent the DRV3 from emitting a tone for very low signal readings, the DRV3 is equipped with a squelch feature that allows you to adjust a threshold level, so only measured signals that are stronger than the selected threshold will trigger an audible tone. You can configure a threshold from 0002 to 2000, in μ V/m. By default, the DRV3 uses μ V/m as its unit of measure.

Rules Governing Sound

In addition to the squelch level criteria, there are tag detection rules associated with the DRV3's audible tone function. If you are using channel tags to identify specific CATV networks for leakage detection, the DRV3 will take these tags into account before generating a tone when leakage is detected at a given frequency. See section 3.2.8 Using Channel Tag Detection on page 25 for information in enabling the tag detection feature in the DRV3.

Tag Detection	Aero/LTE	Squelch threshold	Tone Generated
Enabled and tag detected	Both active	Reached	Yes, on strongest signal detected (either band)
Carrier only	Both active	Reached	Yes, on strongest signal detected (either band)
Enabled and tag detected	Only one band active	Reached	Yes, on signal in active band (other band ignored)
Carrier only	Only one band active	Reached	Yes, on signal in active band (other band ignored)

To adjust the reference volume and the squelch level:

- 1. In the settings menu (page 2), select Sounds.
- 2. To change the reference level, highlight Volume and press the right arrow (▶) to access the volume options. Use the up and down arrows to select the reference level among the available options: mute, low, medium and high. Press **Enter** (←) to save your choice. The cursor automatically returns to the left column.
- 3. To change the squelch threshold, highlight Squelch and press the right arrow (▶) to edit the threshold. Highlight each digit you want to edit and scroll up and down to change the threshold to a value between 0002 to 9999 µV/m.
- 4. Press **Enter** (←) to save the new value. The cursor automatically returns to the left column. Press **Esc** to return to the settings menu and continue configuring other parameters. Press **Esc** again to return to measurement mode.

3.2.6 Setting up Units

The DRV3 can display leakage levels in two different measurement units, in μ V/m or dB μ V/m. The most common unit used to measure signal leaks is μ V/m (microvolts per meter) and this is DRV3's default setting. Note that the squelch feature will always be calculated in μ V/m. However, the DRV3 will apply the units of measure to the snapshot feature (see section 4.3 Using the Snapshot Feature on page 31), depending on which units you have selected.



To change the units of measure:

- 1. In the settings menu (page 2), select Units.
- Press the right arrow (►), then toggle between μV/m and dBμV/m using the up and down arrows.
- 3. Press **Enter** (←) to save your choice. The cursor automatically returns to the left column.
- 4. Continue editing other parameters, if desired, or press **Esc** to return to measurement mode.

3.2.7 Setting up Frequencies

You can configure three (3) preset leakage monitoring frequencies for each of the DRV3's bands. These frequencies vary from one operator to another and can vary within different areas of the operator's network. Make sure that the frequencies you configure in the DRV3 match the leakage monitoring pilot signals used by the operator.



NOTE

Selected frequencies and tagging parameters must match the ones used with the DSG1, installed at the headend, in order to obtain leakage measurements.

To edit any preset frequency and select the active monitoring frequency:

- 1. In the settings menu (page 2), select Frequency.
- 2. Press the right arrow (▶) to access the band and frequency options.
- 3. Select the desired band (Mid/Aero or LTE) and then press the right arrow to display the list of preset frequencies (Freq 1, Freq 2, and Freq 3). The frequency that is currently used is indicated with an asterisk *.
- 4. To edit any preset frequency, scroll through the list until you have highlighted the desired preset, and press the right arrow (▶). You can now use the right and left arrows to move the cursor to the desired digit in the frequency, and then use the up and down arrows to change the value. The new frequency must be within the tuning range of the DRV3 (118 MHz to 140 MHz/mid-band or 572 MHz to 960 MHz/LTE band) in 1 Hz steps.
- 5. To save the new frequency, press **Enter** (←). If you press **Esc** while modifying a frequency, this cancels any changes you made and brings the cursor back to the list of presets.
- 6. Repeat steps 3 to 5 to set up all three presets for each band.
- 7. To select the frequency that you want to use for leakage detection, scroll through the list of preset numbers until you find the one that corresponds to the desired frequency, and press **Enter** (←1). The asterisk (*) appears next to this preset.

8. Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.8 Using Channel Tag Detection

In order to use the DRV3's channel tag detection feature, you must have a channel tagger device, such as the DSG1, that inserts tags in specified channels carried on the CATV network. Channel tagging is commonly used in areas where more than one cable operator is active, and the use of tags allows each operator to identify the leaks that are under its responsibility.

In order to allow the DRV3 to recognize channel tags, you must configure the DRV3's channel tag detection parameters so they match the settings used by the headend channel tagger. The DRV3 supports the detection of AM tags with modulation frequencies varying from 10 Hz to 110 Hz. You can also adjust the detection threshold of the channel tag to allow the DRV3 to discriminate between channel noise and the tag signal.

Once properly set up, you can enable and disable the channel tag detection feature, as may be needed when working in different areas. When the tag detection feature is enabled and the DRV3 detects the tag in the frequency it is monitoring, the letter 't' appears on the main measurement mode screen.

To set up and enable/disable channel tag detection:

- 1. In the settings menu (page 3), select Tag Cfg. The current detection setting is displayed to the right.
- 2. Press the right arrow (▶) to edit the tagging options. An asterisk (*) appears next to the choice that is currently enabled, ether OFF or AM.
- 3. To change the AM frequency for tag detection, highlight AM, then press the right arrow (▶) edit the frequency of the tag's modulation, in hertz. The possible values are from 10 Hz to 110 Hz. Press **Enter** (←) to save the value.
- 4. If necessary, adjust the noise Threshold offset for the channel tag. This value, in dB, allows you to more accurately discriminate the tag signal from the channel's noise floor. The DRV3 will look for a tag signal that is stronger than the channel noise by the number of decibels you configure in the Threshold setting. Highlight Threshold, press the right arrow (▶) and then use the arrow keys to edit each digit of the threshold value for the channel tag, from 10 to 99. Press **Enter** (←) when you are done editing.
- 5. Enable or disable tag detection according to your needs. If tag detection is not already active, enable it by highlighting AM, and then press Enter (←) again to enable tag detection. An asterisk appears, indicating that this mode of detection is now active. In measurement mode, the letter 't' appears when the DRV3 detects the tag in the frequency it is monitor-



ing. To disable tag detection, highlight OFF and press **Enter** (\leftarrow 1). An asterisk appears next to the OFF option, indicating that tag detection is now disabled.

6. Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.9 Setting up Detection

You can configure a minimum threshold for leaks in the Mid or LTE bands before the DRV3 considers that there is leakage. The possible values are from 010 to 099 μ V per meter. The signal leak's strength must be equal to or greater than the value you configure in this setting in order for the DRV3 to indicate leakage.

To edit detection levels:

- 1. In the settings menu (page 3), select Detection. The current detection setting is displayed to the right.
- 2. Select the band (Mid/Aero or LTE) for which you want to edit the detection level. Press the right arrow (▶) to move the cursor to the right column so you can begin editing.
- 3. Using the up and down arrows, change the value of each digit until you obtain the desired detection level from 10 to 99 μ V/m. Press **Enter** (\leftarrow) when you are done editing in order to save the new value.
- 4. Repeat steps 2 and 3 for the other band, as applicable.
- 5. Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.10 Setting up the CW to QAM Delta

You can configure the relative difference in signal strength between the channel tag's carrier wave (CW) signal and the QAM signal of the channel band it is inserted into. This delta in dB allows the DRV3 to provide leakage readings based on the expected QAM levels and not on the channel tag CW signal emitted by the DSG1. The CW signal may be stronger or weaker than the QAM signal. Verify the actual levels before modifying this setting.

To edit the CW to QAM offsets:

- 1. In the settings menu (page 3), select CW/QAM dB.
- 2. Press the right arrow to access the band and offset options.
- 3. Select the desired band (Mid/Aero or LTE) and then press the right arrow to move the cursor to the right column so you can edit each digit from 00 to 99. You can also edit the positive (+) or negative (-) sign that indicates if the offset to be applied is to be added or

subtracted to the measured value. Press **Enter** (←) when you are done editing in order to save the new value.

- 4. Repeat step 3 for the other band, as applicable.
- 5. Press Esc until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.11 Setting up the Backlight

This parameter allows you to determine if the backlight is always on, always off, or if it turns off after a certain period of no keypad activity.

To adjust the backlight properties:

- 1. In the settings menu (page 4), select Backlight. The current setting is displayed to the right.
- 2. Press the right arrow to move to the options and use the up and down arrows to select the backlight properties from the available options:

ON	Remains on (lit)
AUTO 10s	Turns off after 10 seconds if no keys are pressed
AUTO 30s	Turns off after 30 seconds if no keys are pressed
AUTO 60s	Turns off after 60 seconds if no keys are pressed
OFF	No backlight

- 3. Press **Enter** (←) to save your choice.
- 4. Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.12 Setting up Contrast

This parameter controls the screen contrast on the DRV3's display.

To adjust the contrast:

- 1. In the settings menu (page 4), select Contrast. The current setting is displayed to the right.
- 2. Press the right arrow to move to the options and use the up and down arrows to select the contrast value from 0 (least contrast) to 9 (highest contrast).
- 3. Press **Enter** (\leftarrow) to save your choice.



4. Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu and continue configuring other parameters.

3.2.13 Displaying the DRV3's Internal Temperature

This menu item provides a view-only access to the DRV3's temperature.

To view the unit's internal temperature, go to the settings menu (page 4). The current temperature is displayed to the right, in Celsius (C) and in Fahrenheit (F).

Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu to configure or view other parameters.

3.2.14 Displaying the DRV3's Version

This menu item provides a view-only access to the DRV3's internal software versions.

To view the version numbers, go to the settings menu (page 5). The unit's micro-controller version number is displayed to the right of the letter 'M', and the current version of the firmware installed in the device is displayed to the right of the letter 'F'.

Press **Esc** until you return to measurement mode, or press the left arrow (◀) to return to the settings menu to configure or view other parameters.

3.2.15 Displaying the DRV3's Device ID

This menu item provides a view-only access to the DRV3's identification.

To view the device ID, go to the settings menu (page 5). The unit's ID is displayed to the right. Press **Esc** until you return to measurement mode, or press the left arrow (\blacktriangleleft) to return to the settings menu to configure or view other parameters.

4. Operation and Maintenance

4.1 Reading the Measurement Mode Screen

The DRV3 starts up in measurement mode by default, and immediately detects and displays levels for the last frequency selected. Unless the DRV3 has been set up for single band detection, it simultaneously monitors the selected frequencies in the Mid band and the LTE band.

In both modes, the top portion of the screen shows the same information, as follows, from left to right:

Volume:

Shows reference volume level for audible alert upon detecting leaks that exceed squelch criteria. Four (4) settings: mute, low, medium and high. See Sounds section to set up reference level and squelch criteria.

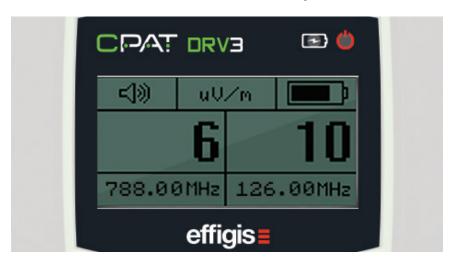
Measurement Units:

Leakage signal strength referenced in these units. User-configurable via settings menus. See section 3.2.6 Setting up Units on page 23.

Battery Charge Status:

Indicates charge (dark fill) when operating on battery power, or shows a plug symbol when the DRV3 is connected to a power source via the docking station or the standalone AC converter

The DRV3's screen in measurement mode shows the following information:





In single-band mode:

Volume icon	Measurement Units		Battery Charge icon
Last leakage level detected at selected frequency			
Frequency			n with level of last snapshot ken (if applicable)

In dual-band mode:

Volume icon	Measurement Units		Battery Charge icon
Last LTE band leakage level detected		Last Mid/Aero	band leakage level detected
Frequency (upon entering measurement mode) Snapshot icon with level of last snapshot taken (if applicable)		Frequency (upon entering measurement mode) Snapshot icon with level of last snapshot taken (if applicable)	

Figure 9: Measurement mode screen

4.2 Adjusting Volume During Normal Use

The DRV3 emits an audible tone to help you locate the leakage source. The tone rises with signal strength, from about 200 Hz to about 800 Hz. In measurement mode, you can enable or mute the audio by pressing the volume key labelled **Esc**. To adjust the reference volume of the audio tone, see section 3.2.5 Setting up Sound on page 22.

4.3 Using the Snapshot Feature

During normal operation, you can capture the actual RF level measurement at your leakage monitoring frequency. This feature can help you compare levels you are reading in different locations or at different distances from the leakage source.

You can take a snapshot by pressing the key labelled (\leftarrow) , which is also the **Enter** key. The captured level will appear in smaller numbers, to the right of the current leakage level reading. To take another snapshot, press the (\leftarrow) key again. The previous level that was captured is cleared and is replaced with the new snapshot.

4.4 Charging the Battery

The DRV3 can operate on battery power for hours when fully charged. The battery status indicator gives the battery charge level.

To maintain good battery health and ensure the longest useful battery life, you must follow these recommendations for charging the battery:

- 1. Use **only** the battery pack and replacement battery pack available from Effigis.
- 2. Use only the chargers available through Effigis. The DRV3's status LED will turn green only when the battery is fully charged.
- Charge the unit at room temperature. Do not place the unit in a location where temperature extremes occur during charging. The DRV3 is equipped with additional protection to prevent the battery from charging when the temperature is above 40°C (104°F) or below 0°C (32°F).

4.5 Replacing the Battery Pack

The rechargeable Li-lon battery pack is accessible via the DRV3's rear panel. You will not need to access the batteries unless they can no longer be recharged.

To change the battery pack:

- 1. Loosen the battery compartment's screw using a Philips head screwdriver and remove the panel.
- 2. Disconnect the 5-pin mating on the cable between the battery pack and the DRV3. Replace the battery pack only with a battery pack from Effigis.
- Plug in the 5-pin connector, and replace the panel on battery compartment. Secure the panel with the screw. In order to avoid damaging the DRV3's housing, do not overtighten the screw.





Figure 10: Battery compartment

4.6 Updating the DRV3's Firmware

From time to time, firmware updates may be available for the DRV3. The update can be automatically pushed by an ARD4, or manually using a computer.

When a new firmware update is available, the Effigis support team will plan update deployment with your CPAT internal manager.

To check which version is currently installed in the DRV3, access the DRV3's setup mode by pressing the up or down arrow and scroll to the Version menu. There are two version numbers, each for different components of the DRV3. The second version number, after the letter F, is the firmware version.

4.7 Cleaning

Your DRV3 unit can be wiped clean with a damp cloth. Do not immerse the unit in water. Avoid solvents and commercial cleaners.

Appendix A - Specifications

A.1 Technical

Detector type	Dual-band digital receiver/demodulator
Frequency range	Agile from 118 to 140 MHz (Mid-band) Agile from 572 to 960 MHz (LTE-band)
Channel tuning	Configurable via USB port and by front panel buttons
Tuning resolution	1 kHz
Level range	2 to 2,000 μ V/m @ 3 meters (Mid-band), 5 μ V/m to 2,000 μ V/m @ 3 meters (LTE-band)
Level accuracy	± 1.5 dB Mid-Band ± 2.5 dB LTE-Band
System tag	AM modulation 10-110 Hz
Audible tone	Yes, varies with leak intensity
Adjustable audio volume	Yes, variable
RF level scale display	Single scale from 0 to 2,000 μV/m
Measurement units	μV/m and dBuV/m
Communication port	USB serial port

A.2 Electrical and Environmental

Power	Pack of 2 rechargeable Li-lon cells, 3.100 mAh
Charging temperature	0° to 45° C / 32° to 110° F
Operation time	2.5 hours nominal (both tuners activated) or 4.0 hours nominal (one tuner activated)

A.3 Physical

Dimensions	21 cm x 11 cm x 4 cm / 8.3" x 4.3" x 1.6" (H X W X D)
Weight	850 g / 30 ounces
Docking Station Dimensions	24 cm x 12.5 cm x 8 cm / 9.4" X 4.9" X 3.2" (H X W X D)
Docking Station Weight	240g / 9 ounces

^{*} Specifications subject to change without prior notice.



Appendix B - Our Services

Effigis offers a portfolio of services to deploy and support purchased equipment through its Customer Support organization. Customer Support is standard with every product sale and consists of business hour technical assistance, in-warranty repair and calibration.

B.1 Customer Support

Customer Support is accompanied with the sale of every Effigis product. Customer Support services include:

- Product and Service Literature
- Technical Assistance (business hours)
- Equipment Repair (Under Warranty Repair and Calibration Services)
- Equipment Return Authorizations

Contact a Customer Support representative through your local distributor or by accessing http://effigis.com for information on calibration and warranty policies.

B.1.1 Equipment Return Instructions

Please contact your local Customer Support location via telephone for Return Authorization to accompany your equipment. For each piece of equipment returned for repair, attach a tag that includes the following information:

- Owner's name, address, and telephone number
- The serial number, product type, and model
- Warranty status (If you are unsure of the warranty status of your instrument, contact Effigis' Customer Support.)
- A detailed description of the problem or service requested
- The name and telephone number of the person to contact regarding questions about the repair
- The return authorization (RA) number

If possible, return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit; when needed, appropriate packing materials can be obtained by contacting Effigis Support. Effigis is not liable for any damage that may occur during shipping. The customer should clearly mark the Effigis' issued RA or reference number on the outside of the package and ship it prepaid and insured to Effigis.

Equipment repaired or replaced under warranty will be returned at Effigis' expense to Customer (Canada/USA) or Effigis' representative (all other countries).

All other non-warranty repairs will be returned at Customer's expense to Customer (Canada/ USA) or Effigis' representative (all other countries).

B.2 Limited Product Warranty

B.2.1 Hardware

Effigis warrants to the original end user (Customer) that the new Effigis branded products will be free from defects in workmanship and materials, under normal use, for one (1) year from the date of original shipment.

Effigis warrants repaired products for ninety (90) days from date of shipment. Any Product repaired or replaced under warranty is only warranted for the period of time remaining in the original warranty for the Product.

Any third party products, including software, included with Effigis products are not covered by this Effigis warranty and Effigis makes no representations or warranties on behalf of such third parties. Any warranty on such products is from the supplier or licensor of the product.

B.2.2 Software

Effigis warrants to the Customer that new Effigis branded software and firmware will perform in substantial conformance to program specifications for a period of ninety (90) days from the date of original shipment. Effigis warrants the media containing software against failure during the warranty period.

Effigis makes no warranty or representation that the operation of the software products will be uninterrupted or error free, or that all defects in the software products will be corrected.

B.2.3 Exclusions

This warranty excludes:

- Damage to the physical surface of the product, including cracks or scratches to any part.
- Damage caused by misuse, neglect, improper installation or testing, unauthorized attempts to open, repair, or modify the product, or any other cause beyond the range of the intended use.
- Use of the product with any non-recommended device or service if such device or service causes the problem.
- Installation or maintenance of Product by someone other than Effigis or persons certified by Effigis



- Changes to the Customer environment in which Product was installed
- Damage caused by accident, fire, power changes, other hazards, or acts of nature.
- Consumable Product or parts thereof (e.g., parts with an expected useful life of less than ninety (90) days, such as certain batteries)
- Product not returned in accordance with Effigis' RA procedure.

B.2.4 Refurbished Parts and Prior Testing

Product may incorporate reconditioned or refurbished parts or subassemblies and may have been used in testing prior to sale.

B.2.5 Exclusive Remedies

If any Product materially fails to conform to the limited warranty set forth in this Section (Limited Warranty) and actually fails during the applicable warranty period and under normal use, Effigis shall, at its sole discretion (i) repair or replace the non-conforming Product to remedy the nonconformity identified by Customer in accordance with this Section (Limited Product Warranty); or (ii) issue a credit to Customer for the amounts paid for the Product in exchange for return of the non-conforming Product, in which case Customer's licenses to any Firmware shall be automatically revoked. Customer hereby transfers to Effigis title and ownership of any parts that Effigis replaces.

B.2.6 Disclaimer

THE REMEDIES EXPRESSLY PROVIDED IN THIS SECTION WILL BE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES AND SHALL BE IN LIEU OF ANY OTHER RIGHTS OR REMEDIES CUSTOMER MAY HAVE AGAINST EFFIGIS WITH RESPECT TO ANY NON-CONFORMANCE OF PRODUCTS. EXCEPT AS SPECIFIED IN THIS LIMITED PRODUCT WARRANTY, EFFIGIS MAKES NO EXPRESS REPRESENTATIONS OR WARRANTIES WITH REGARD TO ANY PRODUCT.

EFFIGIS DISCLAIMS ALL IMPLIED WARRANTIES, CONDITIONS, AND REPRESENTATIONS INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OR CONDITIONS OF MERCHANTABILITY, SATISFACTORY QUALITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT, REGARDLESS OF THE LEGAL THEORY ON WHICH SUCH IMPLIED WARRANTY MAY BE BASED, INCLUDING, WITHOUT LIMITATION, CONTRACT, COURSE OF DEALING, USAGE, OR TRADE PRACTICE.





DRV3 Docking Station Installation





A. Install the Flex post

- 1/ Firmly attach the Flex mount bracket to vehicle floor (3 metal screws not included).
- 2/ Screw the post into bracket.
- 3/ Secure the post with the hexagonal screw.

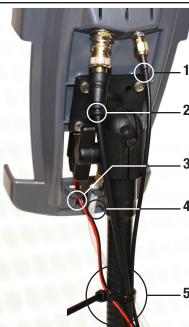
B. Attach docking station

- 1/ Attach the DRV3 docking station to the Flex mount using the 4 pan head Phillips screws (included with the docking station).
- **2/** Adjust docking station orientation and tighten the thumbscrew.



Pan head Phillips screw -

Flex mount post -



$oldsymbol{C}_ullet$ Connect docking station cables

- 1/ SMA cable from vehicle roof antenna (LTE band).
- 2/ BNC cable from vehicle roof antenna (Mid band).
- 3/ DC to vehicle accessories.
- **4/** USB cable (required only if the DRV3 is used with an ARD4).
- . 5/ Secure wires with a cable tie.

D. Connect the DRV3 to ARD4 (optional)

Note: See "CPAT FLEX Operation Manual" for the ARD4 installation details.







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